Predictability of Particle Trajectories in the Ocean

Tamay M. Ozgokmen, Annalisa Griffa, Arthur J. Mariano
Division of Meteorology and Physical Oceanography
Rosenstiel School of Marine and Atmospheric Science
4600 Rickenbacker Causeway, Miami, Florida 33149
phone: (305) 361 4053, fax: (305) 361 4696, email: tozgokmen@rsmas.miami.edu

Award #: N000149910049
http://www.rsmas.miami.edu/LAPCOD

LONG-TERM GOALS

The long term goal of this project is to determine optimal sampling strategies for drifting buoys, in order to enhance prediction of particle motion in the ocean, with potential applications to ecological, search and rescue, the floating mine problems, and design of observing systems.

OBJECTIVES

The specific scientific objective of the work done has been to determine the effectiveness of using in-situ Lagrangian measurements and data assimilation techniques in improving the prediction of particle trajectories.

APPROACH

The work is based primarily on simple probabilistic models of particle motion and data assimilation strategies. It also involves the use of ocean general circulation models and processing of oceanic data.

WORK COMPLETED

The primary accomplishments during this grant period are as follows:

1) A comprehensive testing and validation of a method, which relies on assimilation of Lagrangian data into Lagrangian particle models in order to estimate the velocity field in the vicinity of buoy trajectories and to address the problem of prediction of Lagrangian trajectories have been completed, leading to the publication of 3 papers (Ozgokmen et al., 2000a; Castellari et al., 2001; Ozgokmen et al., 2001).

2) A new algorithm is developed based on the motion of the center of mass of a drifter cluster. This method is tested using stochastic flow simulations and real oceanic drifters. This study is submitted for publication (Piterbarg and Ozgokmen, 2001).

3) The impact of in-situ wind forcing on the reconstruction of drifter trajectories is investigated. This manuscript is submitted for publication (Paldor et al., 2001).

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
30 SEP 2002		**00-00-2002 to 00-00-2002**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Predictability of Particle Trajectories in the Ocean	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Division of Meteorology and Physical Oceanography,,Rosenstiel School of Marine and Atmospheric Science,,4600 Rickenbacker Causeway,,Miami,,FL, 33149**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The long term goal of this project is to determine optimal sampling strategies for drifting buoys, in order to enhance prediction of particle motion in the ocean, with potential applications to ecological, search and rescue, the floating mine problems, and design of observing systems.

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**7**	

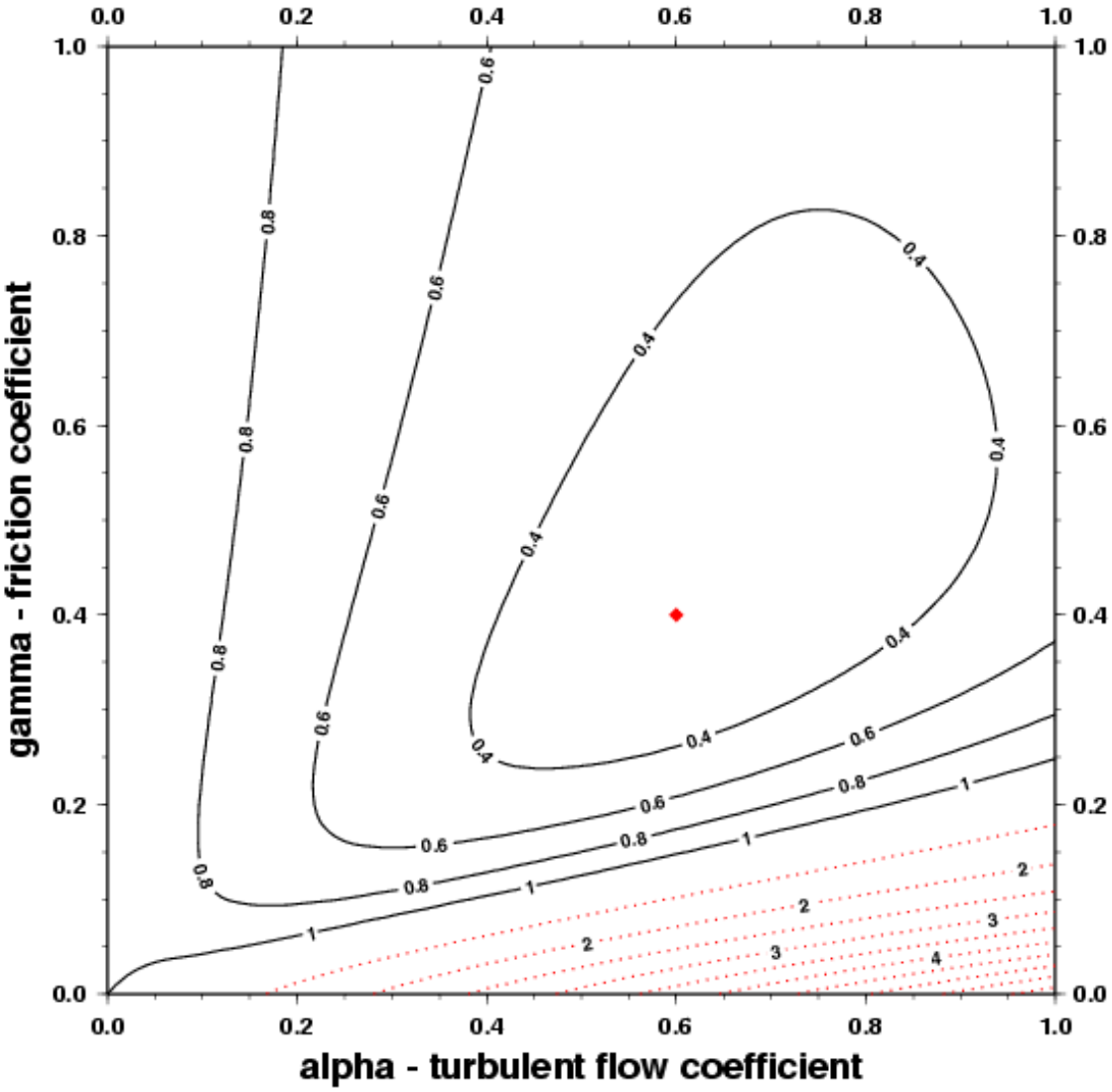

Figure 2: Sensitivity of the relative error, prediction error scaled by dispersion, to the model parameters for one of the drifter clusters in the Pacific Ocean. Note that the minimum error is robust with respect to variations in model parameters, alpha – turbulent flow coefficient and gamma - friction coefficient.

PUBLICATIONS (2000-2001)

Ozgokmen, T.M., A.J. Mariano, A. Griffa and L. Piterbarg, 2000: Predictability analysis of drifter clusters in the tropical Pacific Ocean. EOS Trans. AGU, OS11F.

Ozgokmen, T. M., L.I. Piterbarg, A.J. Mariano, and E.H. Ryan, 2000:Predictability of drifter trajectories in the Tropical Pacific Ocean. Lagrangian Analysis and Predictability of Coastal and Oceanic Dynamics meeting.

Shay, L.K., H. Peters, A.J. Mariano, T. M. Cook, E.H. Ryan, and T.M. Ozgokmen, 2000: Very-High Resolution Mapping of Surface Currents. Lagrangian Analysis and Predictability of Coastal and Oceanic Dynamics meeting.

Ozgokmen, T.M., A. Griffa, L.I. Piterbarg, and A.J. Mariano, 2000a:On the predictability of the Lagrangian trajectories in the ocean.J. Atmos. Ocean. Tech., 17, 366-383.

Castellari, S., A. Griffa, T.M. Ozgokmen and P.-M. Poulain, 2001:Prediction of particle trajectories in the Adriatic Sea using Lagrangian data assimilation. J. Mar. Sys., 29, 33-50.

Ozgokmen, T.M., L.I. Piterbarg, A.J. Mariano, and E. H. Ryan, 2001:Predictability of drifter trajectories in the Tropical Pacific Ocean. J. Phys. Oceanogr., 31, 2691-2720.

Piterbarg, L.I., and T.M. Ozgokmen, 2001: A simple prediction algorithm for the Lagrangian motion in 2D turbulent flows. Submitted to SIAM J. Appl. Math.

Mariano, A.J., A. Griffa, T.M. Ozgokmen, and E. Zambianchi, 2001:Lagrangian Analysis and Predictability of Coastal and Ocean Dynamics 2000. Submitted to J. Atmos. Ocean. Tech.

Paldor, N., A. Mariano, T.M. Ozgokmen, and E. Ryan, 2001: Reconstruction of near-surface drifter trajectories in the Pacific Ocean with a hybrid particle model. Submitted to J. Phys. Oceanogr.